Blue Force Tracking
A Subset of Combat Identification

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AS THE ARMY transforms to lighter, leaner, more lethal future combat systems, Army leaders can draw significant parallels from air combat when considering new combat identification (CID) capabilities. The U.S. Air Force (USAF) has had Blue Force Tracking (BFT) and Blue Force Situational Awareness (BFSA) for decades. Army Transformation planners should consider moving CID out of the oversight of the Joint Staff Command and Control Functional Control Board to the Force Application Functional Control Board.

Identification, Friend or Foe

The British developed an electronic identification device for aircraft during World War II to provide a "friendly" reply to a ground radar's interrogation.[1] The device, appropriately named identification, friend or foe (IFF), was a combination transmitter and receiver (called a transponder) that used a unique signal to identify the aircraft. Because only friendly or enemy combatant aircraft were flying over England, any aircraft not "squawking" was probably a German combatant (or a friendly combatant with malfunctioning equipment). With a lethal envelope of weapons in the visual arena, verification during engagement could reduce the chance that a friendly aircraft would be shot down.

In today's air combat environment, airspace contains more commercial and private aircraft, all equipped with IFF transponders, which routinely transit airspace or approach combat zones. Because the range of air-to-air and surface-to-air weapons systems has expanded, lethal engagement envelopes have also expanded well beyond visual ranges, and the need for identifying friend from foe has required more capabilities.

Transponder modes 1, 2, and 3 on all U.S. military aircraft provide aircraft, flight, or other group or class information. Mode 4, an encrypted code, can only be interrogated by systems with current cryptography codes.[2] Information from these IFF interrogators and transponders feeds the ground and air surveillance radar picture for Joint BFSA (JBFSA) of airspace. Airborne fighters with an advanced interrogation capability can display a piece of the air picture, although their field of regard limits them. A fighter's radar typically only looks in front of the aircraft, and its displays merely overlay the transponder displays with raw radar returns. If an IFF transponder system is inoperative, the interrogation will come up negative, indicating "lack of friendly" (LOF), and the radar return—the IFF—with the wrong code goes into a category called "unknown."

With access to an enemy's IFF and codes, the interrogation of a foe and a subsequent positive response will indicate "presence of enemy" (POE). This does not complete the "kill chain" for engagement, however. The POE identification must be further assessed to determine whether the aircraft present is a combatant with hostile intent (that is, whether a MiG-29 identified is trying to destroy or trying to defect).

Combat Identification

JBFSA interrogation and friendly force response has nothing to do with identifying enemy personnel or equipment; it is only cooperative identification. JBFSA feeds the information into CID by providing information on friendly troops, but it is really only a subset of the overall capabilities required to achieve true CID.

The 2001 CID "Capstone Requirements Document" defines CID as "the process of attaining an accurate characterization of detected objects in the joint battlespace to the extent that high confidence, timely application of military options, and weapons resources can occur."[3] This definition points toward the fundamental objective of destroying the enemy, the end result of closing the links of a kill chain. The USAF talks about a kill chain as a set of capabilities to find, fix, track, target, engage, and assess hostile enemy aircraft.

In the kill-chain sequence, find encompasses locating friendlies, enemies, and neutrals. Fix is the process of characterizing potential targets with suf-

Private and commercial aircraft with IFF transponders regularly approach or pass through combat zones.

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ficient fidelity for proper weaponeering and engagement.[4] Fixing includes the precise location as well as CID of aircraft. Combat identification at this juncture starts with cooperative identification capabilities to determine cooperating friends. But CID requires entirely different capabilities to perform noncooperative identification**.** Noncooperative identification capabilities must distinguish neutrals from enemies to link up the rest of the kill chain.

CID is not final as a pilot transitions from fix to track to target. With sensors and platforms brought into the process, the goal continues to be to engage enemy forces. At any time during this process the kill chain can be broken to prevent fratricide.

The term "fratricide" has taken on disproportionate importance because it describes sensitive incidents. But, if the only goal is to prevent fratricide, one can do so by never firing a shot. From the standpoint of effectively destroying the enemy, fratricide is but one metric by which to measure poor CID.

Procuring capabilities to prevent fratricide is necessary, but elaborate CID capabilities potentially slow down the ability to engage and destroy the enemy. BFT and JBFSA do not complete the kill chain; they break the kill chain. With refresh rates potentially in the range of several minutes, waiting for a BFT interrogation could actually increase force vulnerability.

Air-to-Air Engagements

The response from a BFT interrogation is either "positive friendly" or "unknown." Positive friendly breaks the kill chain. An unknown response requires continuing the CID process; it does not mean engage.

For typical air-to-air rules of engagement (ROE), the logic follows the steps in figure 1. In addition to IFF modes 2, 3, 4, 5, and C (which provides altitude readouts), the pilot can assess LOF using cooperative identification systems like Link 16, interflight datalinks, and JBFSA. Noncooperative identification capabilities include noncooperative target recognition, electronic fingerprinting, a special air-to-air interrogator (mode X), and standard JBFSA surveillance capabilities characterizing the unknown radar contact.

The ROE for the kill chain follows an orderly sequence: determine LOF, determine presence of enemy, and determine whether the enemy is a combatant with hostile intent. The last step, which is not often addressed, must account for a clear avenue of fire, or the wingman crossing between friendly aircraft and the enemy could become a fratricide statistic.

Cooperative identification systems can detect LOF and hostile intent. Noncooperative systems can detect the presence of an enemy or combatant as well as hostile intent. Therefore BFT and JBFSA can only contribute to a portion of CID, which enables completion of the kill chain. Interestingly, BFT and JBFSA can actually close the kill chain—but only for an adversary who has gained access to the friendly aircraft's information. That adversary has LOF, POE, and hostile intent information.

Air-to-Ground Engagements

Similar ROE exist for air-to-ground engagements, but different technologies are required to complete the kill chain (figure 2). The cooperative identification systems currently available to provide the

ground picture to fighters are limited to aircraft and units equipped with situational awareness data links and Enhanced Position Location Reporting Systems. Although Link 16 can share JBFSA with more players, it requires mechanization to work for the fighters. However, Link 16 to a Patriot would provide significant JBFSA for preventing ground-to-air fratricide right now.

In this matrix, POE requires noncooperative identification capabilities like electro-optical and infrared (EO/IR) sensor pods. EO/IR pods with infrared panels on blue vehicles break the kill chain but do not necessarily contribute to JBFSA because they do not feed into the JBFSA ground picture unless the pilot tags friendly contacts and maintains a fix on them for future flights in the battlespace.

Perhaps the acronym JBFSA is as misleading as IFF is for friendly identification capabilities. JBFSA must have defined requirements to fix and track enemy and neutral contacts to provide situational awareness. This will require additional throughput and bandwidth, which is important for the future because the Air Force, Navy, and Marines are investing heavily in capabilities for noncooperative identification on the Joint Strike Fighter. If successful, unknown contacts will be fixed by type as well as specific vehicle identification such as "T-72" (a Soviet tank). Future combat forces will merely have to connect to the Global Information Grid with the right protocols to pull CID information from the single integrated ground picture. With that type of joint Blue and Red Force situational awareness, closing the kill chain only requires the pilot to determine hostile intent.

Ground-to-Ground Engagements

A figure depicting ground ROE would likely contain LOF, POE, hostile action/intent, and a clear avenue of fire. JBFSA can contribute to these overarching CID capabilities, but even for ground-to-ground engagements, the Army will need cooperative and noncooperative identification capabilities to complete the kill chain. JBFSA investments must be balanced by similar investments for finding and destroying the enemy. The faster the kill chain is completed, the faster the objectives of Field Manual 1, *The Army*, can be met:

- Win on the offense.
- Defend well, but win on the offense.
- Initiate combat on our terms—at a time, in a place, and with a method of our own choosing, not the adversary's.
- Gain the initiative, retain it for as long as possible, and never surrender it unless forced to.
- Build momentum quickly.
- Win decisively.[5]

The worst case of fratricide in the Vietnam war occurred during an artillery exchange when the wrong powder charge caused long rounds to hit another U.S. artillery position. The retaliatory counterbattery fire resulted in 90 Americans killed.[6] Good command and control (C2) could likely have prevented the incident. Fratricide from ground-to-ground indirect fires did not occur during Operation Desert Storm; the press reported direct-fire fratricide in ground-to-ground engagements only.

Can C2-level capabilities like JBFSA and BFT help prevent fratricide in direct-fire engagements? Rather than answer that question, we should ask whether C2-level capabilities will destroy the enemy more quickly because the systems that destroy the enemy more quickly allow us to win decisively.

Force Application

The Joint Staff is moving CID oversight from J-85 to Joint Forces Command under the C2 Functional Control Board (FCB). I propose that this move should only include a portion of CID capabilities. While JBFSA and BFT belong in the C2 FCB, the overarching capabilities the warfighter needs for CID should reside in the Force Application FCB in J-8. Force application is where technologies and systems that complete the kill chain need advocacy and expertise.

Force application cannot work in a vacuum because the links to C2 must be two-way. If C2 systems can capture identification, this information must get to the shooter. Similarly, if a shooter captures identification without intent to engage, this Red Force Tracking information should also feed the single integrated operational picture for future engagements. Such connectivity can only happen if C2 and field artillery FCBs work in concert.

CID is more than BFT and BFSA; it is a set of systems with capabilities for cooperative identification and noncooperative identification. CID's goal is not to prevent fratricide; it is to win decisively. ***MR***

NOTES

1. U.S. Congress, Office of Technology Assessment (OTA)-Information Systems Command (ISC) 537, *Who Goes There: Friend or Foe?* (Washington, DC: U.S. Government Printing Office [GPO], June 1993), 18.
2. Mode 5 will soon replace the current encryption system and is the future of military IFF. Mode S will be the future for civilian aircraft in the Global Air Traffic Management System and will transmit information such as aircraft heading, speed, rate of descent, and so forth.
3. Joint Forces Command, "CID Capstone Requirements Document," Joint Staff, Pentagon, Washington, D.C., 19 March 2001.
4. Headquarters, U.S. Air Force, Global Persistent Attack Risk Assessment Team Capability Review and Risk Assessment, Pentagon, Washington, D.C., Fall 2003.
5. U.S. Army Field Manual 1, *The Army* (Washington, DC: GPO, 14 June 2001).
6. OTA-ISC 537, 11.

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